COMPARATOR APPARATUS AND SYSTEM FOR ACTIVITY MONITORS

BACKGROUND OF THE INVENTION

The present invention relates generally to activity monitors, such as actigraphs. More particularly, the invention relates to apparatus and methods by which the operation of such monitors may be recorded and compared against others to determine reliability characteristics thereof.

Activity monitors are known for observing and quantifying certain aspects of movement of a human without the attendant need and involvement of an observer. One such monitor is described in applicant's patent, U.S. Pat. No. 5,197,489, issued Mar. 30, 1993 for "Activity Monitoring Apparatus With Configurable Filters". The monitor disclosed in the '489 patent is described as an actigraph which independently records, on a simultaneous basis, certain levels of activity of its wearer, such as heart rate, respiration rate, muscle and skeletal movement and the like. These particular activities are of a very low frequency and are recorded by the monitor against time. The monitor records these activities by use of an internal, inertial sensor. The subject activities are recorded by the monitor and may subsequently be downloaded into an appropriate analysis device, such as a computer, where the data may be selectively analyzed and printed out. To obtain the data recorded by the monitor, the '489 patent describes an actigraph interface unit, or AIU, which receives the actigraph and provides an interface between the actigraph and a computer.

In the mass production of activity monitors, and particularly in the production of actigraphs disclosed in the '489 patent, it becomes desirable to effectively calibrate the monitors to detect and record the low frequency activities described above. Moreover, it is also desirable to determine the reliability of all the monitors in a particular manufactured lot of the monitors, that is, to determine if they all detect and record the same activity. One means of testing such activity monitors may involve mounting them in serial order on a pendulum in order to replicate the movement of a human. This type of testing involves serial testing of each monitor of a lot and then comparing the data recorded by each individual monitor to determine the efficacy and reliability of operation of the monitors within the tested lot. One obvious disadvantage to this type of reliability testing is that not only does it require a large amount of time and a special test facility, but it also involves the use of an apparatus to induce a physical movement into the monitor. When using such a physical apparatus, care must be taken in order to ensure exact placement of each monitor on the pendulum inasmuch as placement on the pendulum will affect the forces and movement the monitor will undergo.

A need therefore exists for a device for comparing the performance of activity monitors by uniformly exciting such monitors with a constant excitation signal which does not require a complex physical apparatus, such as a pendulum, and which easily records the operational data from a monitor.

Accordingly, it is a general object of the present invention to provide an improved apparatus, system and methods for exciting activity monitors in a manner which is easily reproducible and which may be used to compare the performance of any one activity monitor within a lot of monitors to the remainder of the lot.

Another object of the present invention is to provide a activity monitor comparator which is compact and which replicates ranges of human activity by non-physical means so that the performance of individual activity monitors may be analyzed against other such monitors.

Another object of the present invention is to provide an activity monitor comparator device in which the operational characteristics of activity monitors are stored.

Yet another object of the present invention is to provide an apparatus for activating activity monitors and comparing the data recorded thereby, wherein the apparatus includes a means for generating, and oscillating a magnetic field in response to a predetermined signal which causes an excitation of the activity monitor sensor, the magnetic field being capable of being generated at very low frequencies which replicate the frequencies of muscle and skeletal movement and/or heart and respiration rates.

Yet still another object of the present invention is to provide an activity monitor comparator apparatus which has interface capabilities for data exchange between an activity monitor and a host computer and which has an excitation circuit which electronically excites an activity monitor sensor in order to replicate human activity of a low frequency nature, the excitation being effected by a digital input which is converted to an analog signal.

SUMMARY OF THE INVENTION

The present invention is directed to an activity monitor comparator and methods by which the recording of activities may be induced in activity monitors in serial order in a plurality of activity monitors in which the monitors utilize an activity sensor of the accelerometer type which exhibits responsiveness to a magnetic field, so that the activity recorded in each such monitor may be accurately recorded and compared against each other.

In accordance with these and other objects, the present invention includes a housing for the comparator having an activity monitor engagement portion thereon which holds, the activity monitor motionless during testing. One preferred embodiment of the comparator includes a compact housing suitable for positioning upon a desk near a computer.

In particular, the comparator of the present invention includes a means for exciting the activity monitor sensor to replicate certain human or test activities, while the monitor is held motionless in a test fixture. A preferred excitation means is an electromagnet which receives a control signal in the form of an analog waveform generated by a digital-to-analog converter and which generates a magnetic field of a particular strength and at a particular frequency in order to replicate a range of human activity. This magnetic field operates to excite, or deflect, the activity monitor sensor during a test. After the excitation period or test completion, the comparator serves as an interface with a host computer so that the activity recorded by the activity monitor may be compared with the activity represented by the excitation of the comparator. In order to ensure accuracy in testing, a means for generating precise and controllable excitation waveforms is provided so that a variety of waveforms which replicate various levels of human activity may be used for testing by the comparator.

In the preferred embodiment, the comparator may utilize an address generator for generating the precise and reproducible excitation waveforms that are applied to a read-only memory (ROM). The ROM is in communication with a digital-to-analog converter which controls a power means which in turn feeds the electromagnet at a predetermined frequency so that the electromagnet generates a magnetic field in a pulsing manner to thereby excite the monitor in a manner virtually identical to the initial testing waveform.